



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/824,959	04/14/2004	Gang Xiao	904.0101.U2(US)	7459
29683	7590	07/27/2005	EXAMINER	
HARRINGTON & SMITH, LLP			MAI, ANH D	
4 RESEARCH DRIVE			ART UNIT	
SHELTON, CT 06484-6212			PAPER NUMBER	
			2814	

DATE MAILED: 07/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

AK

Office Action Summary	Application No.		Applicant(s)	
	10/824,959		XIAO ET AL.	
	Examiner		Art Unit	
	Anh D. Mai		2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 May 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 22-43 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 22-43 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 April 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>4/14/2004</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION***Election/Restrictions***

1. In Paper No. 5/31/2005, applicants acknowledge that, claims 1-21 have been canceled as indicated in the Preliminary Amendment filed April 14, 2004. Therefore the restriction is withdrawn. Action on merits of claims 22-43 follows.

Status of the Claims

2. Amendment filed May 31, 2005 has been entered. Claims 1-21 have been cancelled. Claims 22-43 are pending.

Drawings

3. The drawings are objected to because both specification and claims indicate the "Ni-Fe" as $\text{Ni}_{81}\text{Fe}_{19}$, however, the drawing Figs. 1A, 2A, 2B and 4B show -- $\text{Fe}_{81}\text{Ni}_{19}$ --. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and

Art Unit: 2814

informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 22, 24-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fontana, Jr. et al. (U.S. Patent No. 6,005,753) of record.

With respect to claim 22, insofar as the *device* is concerned, Fontana teaches a magnetic tunneling junction (MTJ) device as claimed including:

a multi-layered structure (100) over a substrate (9), the multi-layered structure (100) comprises a buffer layer (102), a seed layer (112), an antiferromagnetic layer (116)

Art Unit: 2814

comprised of FeMn, a pinned layer (118), a barrier layer (120), a free layer (132), and a passivation layer (134); wherein the multi-layered structure (100) is annealed. (See Fig. 4).

Product by process limitation:

The expression “depositing” and “annealing said multi-layered structure at a temperature between about 168 °C and 170 °C” is/are taken to be a product by process limitation and is given no patentable weight. A product by process claim directed to the product per se, no matter how actually made, *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See *In re Fessman*, 180 USPQ 324, 326 (CCPA 1974); *In re Marosi et al.*, 218 USPQ 289, 292 (Fed. Cir. 1983); *In re Brown*, 459 F.2d 531, 535, 173 USPQ 685, 688 (CCPA 1972); *In re Pilkington*, 411 F.2d 1345, 1348, 162 USPQ 145, 147 (CCPA 1969); *Buono v. Yankee Maid Dress Corp.*, 77 F.2d 274, 279, 26 USPQ 57, 61 (2d. Cir. 1935); and particularly *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985), all of which make it clear that it is the patentability of the final structure of the product “gleaned” from the process steps, which must be determined in a “product by process” claim, and not the patentability of the process. See also MPEP 2113. Moreover, an old and obvious product produced by a new method is not a patentable product, whether claimed in “product by process” claims or not.

Note that Applicant has burden of proof in such cases as the above case law makes clear.

Since the multi-layered structure (100) of Fontana is annealed, the limitation of the claim is met.

Art Unit: 2814

With respect to claim 24, the seed layer (112) of Fontana comprises of $\text{Ni}_{81}\text{Fe}_{19}$.

With respect to claim 25, the pinned layer (118) of Fontana comprises of $\text{Ni}_{81}\text{Fe}_{19}$.

With respect to claim 26, the barrier layer (120) of Fontana comprises of Al_2O_3 .

With respect to claim 27, the free layer (132) of Fontana comprises of $\text{Ni}_{81}\text{Fe}_{19}$.

With respect to claim 28, the buffer layer (102) of Fontana has a thickness that includes the claimed thickness of about 30 nm.

With respect to claim 29, the seed layer (112) of Fontana has a thickness of 4 nm, which is about the claimed thickness.

With respect to claim 30, the antiferromagnetic layer (116) of Fontana has a thickness of 10 nm, which is about the claimed thickness.

With respect to claim 31, the pinned layer (118) of Fontana has a thickness of 8 nm, which is about the claimed thickness.

With respect to claim 32, the barrier layer (120) of Fontana has a thickness of about 0.5 nm to about 2 nm, the barrier layer (120) being characterized by a substantially amorphous structure with little or no crystallinity. Note that, the barrier layer (120) of Fontana is formed the way as that of the instant barrier layer, thus same process same result.

With respect to claim 33, the free layer (132) of Fontana has a thickness of about 5 nm. However, the claimed thickness, 12 nm, do not appear to be critical.

Note that the specification contains no disclosure of either the *critical nature of the claimed thickness of 12 nm*, of any unexpected results arising therefrom. Where

Art Unit: 2814

patentability is aid to based upon particular chosen dimension or upon another variable recited in a claim, the Applicant must show that the chosen dimension are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

With respect to claim 34, insofar as the device is concerned, the barrier layer (120) of Fontana comprises the same material as claimed.

With respect to claim 35, insofar as the device is concerned, the free layer (132) of Fontana comprises the same material as claimed.

Product by process limitation:

The expression “formed by oxidizing a layer of Al in radio frequency O₂ glow discharge” (claim 34) and layer is deposited in a substantially oxygen free environment” (claim 35) is/are taken to be a product by process limitation and is given no patentable weight. A product by process claim directed to the product per se, no matter how actually made, *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See *In re Fessman*, 180 USPQ 324, 326 (CCPA 1974); *In re Marosi et al.*, 218 USPQ 289, 292 (Fed. Cir. 1983); *In re Brown*, 459 F.2d 531, 535, 173 USPQ 685, 688 (CCPA 1972); *In re Pilkington*, 411 F.2d 1345, 1348, 162 USPQ 145, 147 (CCPA 1969); *Buono v. Yankee Maid Dress Corp.*, 77 F.2d 274, 279, 26 USPQ 57, 61 (2d. Cir. 1935); and particularly *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985), all of which make it clear that it is the patentability of the final structure of the product “gleaned” from the process steps, which must be determined in a “product by process” claim, and not the patentability of the process. See also MPEP

Art Unit: 2814

2113. Moreover, an old and obvious product produced by a new method is not a patentable product, whether claimed in "product by process" claims or not.

Note that Applicant has burden of proof in such cases as the above case law makes clear.

With respect to claim 36-39, since the multi-layers structure (100) of Fontana comprises the same materials, similar thicknesses and annealed, thus, the device of Fontana should obviously having the similar sensitivity, capable of producing an antiferromagnet/ferromagnet exchange bias, magnetic noise reduction and magnetoresistance ratio similar as claimed.

With respect to claims 40 and 41, the magnetic tunneling junction device of Fontana can be a part of a sensor device or a part of a memory device.

6. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fontana '753 as applied to claim 22 above, and further in view of Gallagher et al. (U.S. Patent No. 5,650,958) of record.

Fontana is shown to teach all the features of the claim with the exception of utilizing Pt for the buffer layer (102).

However, Gallagher teaches an MTJ device including Pt buffer layer (12). (See Fig. 4A).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the buffer layer of Fontana using Pt as taught by Gallagher

Art Unit: 2814

since, similar to Ta, Pt also promote the (111) growth of the face-centered cubic seed layer.

7. Claims 42 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fontana '753 in view of Michijima et al. (U.S. Patent No. 6,396,735).

Insofar as the *device* is concerned, Fontana teaches a magnetic tunneling junction (MTJ) device as claimed including:

a multi-layered structure (100) over a substrate (9), the multi-layered structure (100) including a buffer layer (102), a seed layer (112), an antiferromagnetic layer (116), a pinned layer (118), a barrier layer (120), a free layer (132), and a passivation layer (134); wherein the multi-layered structure (100) is annealed under conditions determined to simultaneously optimize at least the magnetoresistance, electrical resistance, sensitivity and magnetic noise. (See Fig. 4).

Thus, Fontana is shown to teach all the features of the claim with the exception of utilizing other materials for the antiferromagnetic layer (116).

However, Michijima teaches an MTJ device including an antiferromagnetic layer (11) is formed using alloys such as FeMn, PtMn and IrMn.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the antiferromagnetic layer of Fontana utilizing materials, PtMn or IrMn as taught by Michijima since these materials can be used interchangeably.

Art Unit: 2814

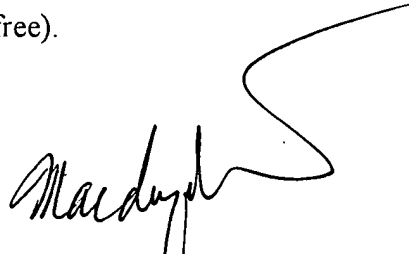
Further, since the device of Fontana is annealed, thus, the device of Fontana, in view of Michijima also optimize at least the magnetoresistance, electrical resistance, sensitivity and magnetic noise as claimed, same process same result.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (571) 272-1710. The examiner can normally be reached on 8:00AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



ANH D. MAI
PRIMARY EXAMINER